This is a detail, but it is of prime importance.

For each subject, as Astronomy, appoint a Director who should be the best man obtainable, but who may be any competent and faithful astronomer, even if he is without very wide experience and reading. Let each Director go over the author-indexes already in type, and mark each entry there printed with the numerals expressing its class or classes. Many, in fact most, of these papers can be pretty well classified from their titles alone, especially if the subject-index is not too minutely subdivided. All cases of doubt must be resolved by a reference to the original memoir. A clerk follows the Director. He finds under *Newcomb* certain papers which have been marked by the Director as relating to Astronomical Optics—Class XXXII., say. He, therefore, collects these on a card, thus:

XXXII.

Newcomb (S): Nos. 1, 11, 19, 26 (vol. I.).

In a subsequent volume he finds other entries belonging under class XXXII. and under *Newcomb*, and makes a separate card for them, noting the volume. The same thing is done by the Director for Astronomy for all his classes and for each author; and by the Directors of other subjects in like manner; and they are followed by copyists. Finally all cards are sorted into one series:

First, by the class—as XXXII.

Second, alphabetically by authors, and then revised and printed thus.

Class XXXII.—Astronomical Optics—Optics of the Telescope; see also classes XCV., etc., etc.

Abbe (C): Vol. i., 17, 34; ii., 80; ix., 92, etc.

Albrecht (T): Vol. vii., 13; viii., 31.

Auwers (A): ii., 7, 23; iii., 18, 37; iv., etc., etc., etc., etc.

By following out this plan under intelligent Directors for the special topics, the Royal Society would very soon have a nearly complete subject-index in one volume, covering its author-indexes, vols. i.–x.; and the plan, once in operation, could be carried on without trouble and at small expense. Such a subject-index would, in my view, supply all real needs in science. It certainly would in my branch of it.

The only objection that I can see to this plan is that it is not perfectly complete and logical to the extremest point. If the preface to the proposed book declares that it is not intended to be so, it seems to me that the Royal Society need not mind. After the book was printed it would, I think, be used by everyone; and it would, I believe, meet the wants of every one as nearly as any practicable plan could do.

If I have extended my remarks too far, I beg you to excuse me. I have desired to show what seems to me to be an easily obtained benefit to science, and I trust my suggestion is not impertinent to your inquiry. I am, My Dear Sir, with high regard,

Very faithfully yours,

Edward S. Holden.

SCIENTIFIC LITERATURE.

Ein Geologischer Querschnitt durch die Ost-Alpen, nebst Anhang über die sog. Glarner Doppelfalte von A. Rothpletz, mit 2 Tafeln und 115 Abbildungen im Text. Stuttgart. 1894. Pp. 268.

This valuable contribution to our knowledge of mountain structure is arranged in three parts. The first of these is a statement of the petrography and stratigraphy, and the second an account of the tectonic, of a cross-section of the Alps, in the meridian of Munich, from the plain of the Po to the Bavarian plateau, a distance of about 230 km. The third part is a discussion of the general results of the author's study. The details of the first two parts are well illustrated, both by the fine geologically colored profile on a scale of $\frac{1}{75000}$, and by

the numerous excellent cuts throughout the text. Only the conclusions of the author can be adverted to in the present brief notice.

The eastern Alps have an east and west trend and the section is normal to the strike. The highest mountains have an elevation of about 3500 m., and lie towards the northern end of the section. The average elevation is 1800 m. In the northern Alps there are three principal folds, in the middle Alps four, and in the southern three, with many subordinate folds throughout. None of these folds remain in their original continuity. Fractures separate one from another and chop each of them up into a series of blocks. By faulting on these fractures the folded arrangement of the strata is greatly disturbed and obscured.

The special features of the faulting are:

1. The prevalent dislocation of synclines in such a manner that their axial troughs are thrust up and the wings dropped.

2. Anticlines with dropped crests so that the newer strata of the crests appear below the older strata of the wings. Not well exemplified in the section.

3. The occasional downthrow of the axial troughs of synclines with uplift of both wings.

4. The faulting of anticlines on longitudinal axial planes and the conversion of the convexity of the anticlines into concavity by subsequent compression.

5. Thrusts. There are five important overthrusts in the section ranging in inclination from 20° to 70°, the overthrust in all cases being toward the south.

6. Cross fractures. Highly inclined to the longitudinal faults and generally nearly vertical. These are not expressible on the profile, but are of the utmost importance for a proper appreciation of Alpine structure. They are subsequent to the folds and associated longitudinal faults, and are the latest manifestations of the orogenic forces. As such they have exerted a powerful influence upon the topography, giving the Alps, in the opinion of the author, their transverse drainage outlets and many of their lake basins.

7. There are also faults which antedate the period of Alpine folding.

In discussing the age of the folding of the Alps the author makes it clear that there have been at least two chief periods of folding, one pre-Permian, and the other post-Miocene. There were, however, diastrophic movements in the interval. This is proved, first, by the faults which antedate the later folding, and second, by the oscillation of the ocean border in the intervening time. In discussing the latter argument the author gives a series of nine profiles showing the hypothetical relative distribution of land and water over the Alpine region in *old Paleozoic*, *Permian*, *Muschelkalk*, *Rhætic*, *Lias*, *Neocomian*, *Eocene*, *Miocene* and the *Present*. These show a trangression of the sea up to the close of the Triassic, followed by a steady recession from then on to the present time. The sections, considered by themselves, might lend support to the hypothesis of Suess that the oscillation is due to the variation of the surface of the ocean. But other sections in neighboring parts of the Alps give discordant results, and it is concluded that the Alpine region was the scene of diastrophic movement between the Permian and Miocene, whether the ocean surface oscillated or remained constant.

The shortening of the arc of the earth's surface in the line of the author's section is 18 per cent., *i. e.*, the region has, in consequence of the folding, now only about four-fifths of its original breadth. If the folding of the central Alps be assumed to be pre-Alpine, then the shortening is reduced to from 12 to 13 per cent., or about one-eighth. The author contrasts these

figures with the much higher values obtained by Heim, who places the shortening of the arc in the north and central Swiss-Alps at one-half. He discredits the structural interpretations which have led Heim to so large a value. He takes issue with the latter, particularly in the interpretation of the so-called Glarner double fold, and discusses this structure at length in an appendix to the volume, interpreting the structure as an overthrust and not a double fold.

In discussing the mechanics of the lateral thrust, to which all are agreed the Alpine structure is due, the author says the earth's crust may be considered a virtual arch. Then the continents must be either arches of less radius than that of the earth as a whole, or they must be superficial masses reposing upon the arch. In the latter case the continental masses would suffer no folding, but would lie as a dead weight upon the laterally compressed and folding arch below. This being contrary to experience, it is rejected, and the alternative is adopted that the continents are arches of smaller radius. The condition of folding of strata by lateral compression is, then, that they must lie below the limiting curve of the continental arch. So long as they lie above this curve they escape folding. Where folding occurs under the dead weight of rocks lying above the curve it is manifest at the surface only as elevation or depression. But the load tends to restrain folding and the latter takes place most readily where the load is least. This occurs where the continental arch merges into the geoid arch. Here is the weakest part of the arch; here the strongest folding should arise. Orogenic folding is most effective on the borders of the oceans. This fact the author finds in accord with his theoretical deductions, for it is on the oceanic borders that the continental and geoid arches intersect.

This principle is resorted to in explanation of the common up-throw of synclinal troughs. The deep synclinal folds will suffer most from the lateral compression. The consequence is that the axial troughs of the synclines are faulted up and the anticlines relatively dropped.

Part of the transverse cleavage of the rocks is ascribable to pre-Permian orogenic forces and part to the later compression which gave rise to the Alps. Most of the pre-Permian strata show this cleavage in a pronounced degree. This cleavage is best developed in the Zillerthaler towards the middle of the section, and least so on the margins of the Alpine region. The author suggests, in explanation of this deficiency of cleavage on the margins, that these parts were folded under a less load than the more central portions and were earlier lifted above the line of compression. The limestones are characterized by suture-like cracks so well known in limestones and marbles the world over. These are held by the author to be due to solution under pressure, and evidence in favor of this view is adduced.

The discussion of the metamorphism is perhaps the least important section of the book, and contributes little of importance to the general subject.

The discussion of the *cause* of mountain uplift and folding is chiefly interesting for the clear and concise statement of the expansion theory as an adequate explanation of the origin of mountain structures and plateau uplifts. The advantages of this theory over the doctrine of the earth's contraction under secular cooling are clearly set forth. The doctrine of secular contraction fails to give an adequate explanation of the phenomena of volcanology; it does not account for the distribution of the force of gravity; and it involves too great a shortening of the earth's radius. The expansion theory does not have these objec-

tions. The admissibility of the expansion theory is based on the assumption that the earth magma *may* expand on solidifying as water does. The recent work of Barnes, however, with which our author was probably not familiar at the time he wrote, so invalidates this assumption that it is no longer worthy of serious consideration.

A. C. LAWSON.

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Mesozoic Plants From Kōsuke, Kii, Awa and Tosa. By METAJIRO YOKOYOMA, Professor in the Imperial University of Japan.

In this paper, illustrated by nine plates of good figures, and published as part III., Vol. VII., of the *Journal of the College of Science*, Imperial University of Japan, Professor Yokoyoma has given us a valuable addition to our knowledge of the lower Cretaceous flora. The plants of this age, known for a long time mostly in their Wealden types, and from a few localities in England and on the continent of Europe, have, by recent discoveries, been greatly increased in number and variety. The extent of the territory known to have been occupied by them has of late been still more notably enlarged. We now know lower Cretaceous plants from such widely separated series of strata as the Potomac of the Atlantic States; the Comanche series of Texas, the coal group of Great Falls, Montana; the Kootanie series of British Columbia; the Shasta group of California; the lower strata of Newton's Dakota group in Dakota and Wyoming. Professor Yokoyoma's investigations add still another region on the Asiatic side of the Pacific, and make it probable that the lower Cretaceous flora was in Asia no less important than it was in North America. These additions are especially gratifying, as the flora of this time was the last one in which angiosperms did not predominate. It is the flora of an era when predominating Mesozoic elements were about to disappear forever. If we are ever to learn what changes caused a flora consisting only of Equiseta, Cycads, Ferns and Conifers to give way to one in which angiosperms overwhelmingly predominate, and in which all these groups, except the conifers, play an insignificant part, we shall most probably find the solution of this as yet unsolved problem from the examination of lower Cretaceous plants.

In 1890 Prof. Nathorst, of Stockholm, examined a number of fossil plants from Shikoku, Japan, and determined their age to be either upper Jurassic or Wealden. Professor Yokoyoma states that he was induced to carry the investigation of this flora farther than the Swedish paleontologist had done, with the hope of fixing more definitely its age. In consequence of this he collected not only from the localities of Nathorst, but from several others showing a similar flora. He succeeded in adding a number of species not seen by Nathorst, and in procuring, in some cases, better specimens of those previously obtained. In this way the total number of species was brought up to 26, with 2 varieties. It is noteworthy that, while the flora is without doubt lower Cretaceous in age, as Professor Yokoyoma determines it to be, it contains no angiosperms. He identifies several of the species with certain ones found in the lower Potomac strata of the eastern United States. He states his conclusion as to the age of the plants in the following words: "I go a step farther than Professor Nathorst and say that the plant-bearing beds of Kozuki, Kii and Shikoku represent the whole Neocomian series, corresponding to the Potomac of America." This statement, so far as the Potomac is concerned, would be more correct if it made the Japanese beds correspond to the *lower* Potomac. American geologists now include in the Potomac the Tuscaloosa group and the South Amboy series of beds, both of which contain few, if